

SHORT COMMUNICATION

HARVESTMEN AS COMMENSALS OF CRAB SPIDERS

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ABSTRACT. Harvestmen *Phalangium opilio* regularly feed upon the carcasses of bees and moths discarded by crab spiders *Misumena vatia* Clerck 1757 hunting on flowers. I report one observation of a harvestman unsuccessfully attempting to secure a bee still being fed on by a crab spider.

Keywords: *Phalangium opilio*, *Misumena vatia*, Opiliones, scavenger, kleptoparasite

Harvestmen (Opiliones) are important consumers that feed upon a wide variety of animal and vegetable items, including both dead and live small invertebrates (Bishop 1949; Cloudsley-Thompson 1968). Although largely confined to the understory and litter during sunny conditions, a consequence of their limited ability to withstand desiccation (Bishop 1949; Cloudsley-Thompson 1968), harvestmen may wander widely over the vegetation, including large flowers and inflorescences, at night and at other times of high humidity (Todd 1949; Edgar 1971). The latter sites, such as inflorescences of common milkweed *Asclepias syriaca* also attract many insects, as well as their predators, one of the most common in northeastern North America being the crab spider *Misumena vatia* Clerck 1757 (Araneae: Thomisidae), a sit-and-wait predator (Morse 1981). Adult female *M. vatia* capture large prey, including bumble bees, honey bees, wasps, and noctuid moths (Morse 1986). Since the spiders feed without masticating these prey, the released carcasses drop intact, frequently lodging on lower parts of the vegetation in the process and providing a resource for scavengers. In our study site, an old field in Bremen, Lincoln County, Maine, USA (Morse 1981), these discarded carcasses sometimes accumulated on the broad milkweed leaves below the inflorescences, often remaining there for several days. However, when collecting carcasses for an unrelated analysis (Fritz & Morse 1985), we noted that many of them disappeared within a day of being dropped by the spiders, even during clear, calm periods when they were unlikely to be blown away by wind or washed off by rain. A few of these carcasses were also dismembered, probably where they had been dropped. These observations suggested the work of harvestmen, since harvestmen often carry food items away from a site and also process

large items by dismembering them (Cloudsley-Thompson 1968; Edgar 1971). Also, the harvestman *Phalangium opilio* Linnaeus 1758 (Phalangidae, Palpatores) commonly visited flowering milkweeds in the study area during the night (recorded on 42.7% of censuses between 2100–0130 h of 100 inflorescences over a 10 year period, $n = 157$, unpubl. data).

To establish why these carcasses disappeared quickly, we collected eight sets of eight carcasses ($n = 64$) discarded by *M. vatia*, dusted them with red micronite dye, placed them under milkweed stems in the middle of the study site at three-day intervals (one set for each interval) and monitored them. Sixty of the 64 dyed carcasses were partly or totally dismembered or removed on the night after they were placed in the field. In 10 instances we subsequently found dyed carcasses, or parts of them, as high as 45 cm above the ground on leaves of the milkweed plants, and as far as 95 cm away from where we had placed them, indicating that they had been actively carried there. Edgar (1971) reported that harvestmen might carry food to sites of low disturbance, including tree trunks. Using pit-fall traps, we subsequently captured seven *P. opilio* with mouthparts and facial regions covered by red dye, which they could have obtained only from the insect carcasses. Ants (Formicidae), the other important scavengers in the study area, were unlikely to have removed or processed the carcasses because the carcasses were manipulated only at night. Ant activity in this area is largely diurnal (Fritz & Morse 1981).

To explore the scavenging habits of *P. opilio* further, we confined 12 of them in 4-liter glass containers, one per container, and presented them with discarded spider prey. All fed heavily on these carcasses, in the process tearing them into smaller

parts similar to those found near the sites of the "food" caches and on the lower leaves of the milkweed. Nine of the 12 attacked the carcasses during the day (164.4 ± 75.4 min after they were placed in the containers), while the remaining three attacked the carcasses during the following evening. The substantial lag time for exploitation of these carcasses in the field (none taken until the following evening) is thus probably a consequence of the low activity levels of harvestmen during the middle of warm, dry days, conditions not experienced in the shade and relatively high humidity of the laboratory.

Given the apparent high frequency of scavenging by the harvestmen, it is of interest to know whether they kleptoparasitize the spiders while the latter are feeding on their large prey, an act that could provide considerably larger rewards for the harvestmen than the spent carcasses. Here I report an observation of a *P. opilio* attempting to wrest control of the honey bee *Apis mellifera* prey of an adult female *M. vatia*. We made this observation under illumination of a battery-driven headlamp covered by a red filter. Neither the harvestman nor the spider showed any sign of being affected by the resulting red light. At 2125 h on 21 July 1982, shortly after darkness, we observed an adult *P. opilio* on an inflorescence of a common milkweed in full flower. Within this inflorescence, approximately 3 cm away, an adult female *M. vatia* was still feeding on a honey bee it had captured at 1430 h the preceding afternoon. Although the spider was largely buried within the flowers of the inflorescence, its prey was located on the outside of that inflorescence in a conspicuous and seemingly vulnerable position. The harvestman initially moved to the end of the bee opposite the spider (the bee's abdomen) and attempted to grasp it with its mouthparts three different times within a few seconds. Each time the spider responded aggressively to the approaches of the harvestman by rearing and rapidly moving its large forelimbs forward. In response, the harvestman quickly retreated backward for one to two bee lengths, simultaneously lowering its body so that it was situated immediately behind the bee. Rapidly following each thrust and retraction by the spider, the harvestman lunged forward in an apparent attempt to secure the bee carcass. In a final effort the harvestman quickly advanced on top of the bee, but during the rapid subsequent response by the spider the harvestman fell off the umbel and dropped into the grass about 80 cm below its previous location. We observed it there for 10 min; but it did not attempt to climb back up the plant, and eventually it wandered away from the plant.

Misumena vatia would be unlikely to take the harvestman as prey, although spiders are often listed as regular predators of harvestmen (Edgar 1971). We have never seen *M. vatia* with harvestman prey,

although logging thousands of hours of field observations on them in over 20 years (1977–2000), both by day and night, and documenting a wide variety of other prey taken by this spider (pers. obs.). Further, as implied, *P. opilio* is common in the study area and regularly recorded in censuses (unpubl. data). Therefore the danger inherent in this act, often cited as an important tradeoff of kleptoparasitism (Whitehouse 1997), seems low and unlikely to inhibit the harvestman's effort to secure the food item. In common with other Palpatores, *P. opilio* possesses large, anterolateral exocrine glands (Bishop 1949), which contain noxious secretions that appear to deter many potential predators (Edgar 1971). However, we have found the brown crab spider *Xysticus emertoni* Keyserling 1880, a far less frequent visitor to flowers than *M. vatia*, feeding on *P. opilio* (pers. obs.). *Xysticus emertoni* regularly feeds on putatively noxious prey that we have never seen *M. vatia* exploit (Morse 1983).

The ready exploitation of spent prey by *P. opilio* strongly suggests that the interaction between this harvestman and the spider was an extension of normal scavenger behavior, though the repeated attempts to wrest the bee carcass from the spider were consistent with predatory behavior by the harvestman. *Phalangium opilio* is well known to prey on small invertebrates (Bristowe 1949). Sabini & Gnaspini (1999) have recently reported an instance of a tropical gonyleptid species taking a moth from a ctenid spider hunting on a tree trunk, which they believe to be the first reported instance of kleptoparasitism by a harvestman. Nearly all instances of probable kleptoparasitism involving spiders have been reported from web-building species, probably because of the relatively high availability of prey there and the web owner's difficulty of patrolling all parts of large webs (Vollrath 1987; Cangialosi 1997; Grostal & Walter 1997).

As we have observed this interaction only once, it seems unlikely to be common, although it would not be observed routinely, given the time of day at which it occurred. It would appear unlikely to result in a major loss of resources to the spiders, especially if such attacks took place after the carcass had been almost completely processed, as in the present instance, when the spider had already retained the bee considerably longer than usual (Morse & Fritz 1982). Even then, the spider showed no tendency to give up its prey to the harvestman, so it remains unclear whether *P. opilio* would often succeed in appropriating such food items before they were discarded by their original exploiters. It thus seems premature to consider *P. opilio* to be a kleptoparasite of *M. vatia*. However, *P. opilio* clearly benefits as a commensal of *M. vatia*, obtaining a resource that would otherwise be unavailable to it.

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LITERATURE CITED

- Bishop, S.C. 1949. The Phalangida (Opiliones) of New York. *Proceedings of the Rochester Academy of Science* 9:159–235.
- Bristowe, W.S. 1949. The distribution of harvestmen (Phalangida) in Great Britain and Ireland, with notes on their names, enemies and food. *Journal of Animal Ecology* 18:100–114.
- Cangialosi, K.R. 1997. Foraging versatility and the influence of host availability in *Argyrodes trigonum* (Araneae, Theridiidae). *Journal of Arachnology* 25:182–193.
- Cloudsley-Thompson, J.L. 1968. *Spiders, Scorpions, Centipedes and Mites*. Oxford: Pergamon.
- Edgar, A.L. 1971. Studies on the biology and ecology of Michigan Phalangida (Opiliones). *Miscellaneous Publications of the Museum of Zoology, University of Michigan* 144:1–64.
- Eisner, T., D. Alsop & J. Meinwald. 1978. Secretions of opilionids, whip scorpions and pseudoscorpions. Pp. 87–99. *In* *Arthropod Venoms*. (S. Bettini, ed.), Springer-Verlag, Berlin.
- Fritz, R.S. & D.H. Morse. 1985. Reproductive success, growth rate and foraging decisions of the crab spider *Misumena vatia*. *Oecologia* 65:194–200.
- Grostal, P. & D.E. Walter. 1997. Kleptoparasites or commensals? Effect of *Argyrodes antipodanus* (Araneae: Theridiidae) on *Nephila plumipes* (Araneae: Tetragnathidae). *Oecologia* 111:570–574.
- Morse, D.H. 1981. Prey capture by the crab spider *Misumena vatia* (L.) (Thomisidae) on three common native flowers. *American Midland Naturalist* 105:358–367.
- Morse, D.H. 1982. The turnover of milkweed pollinia on bumble bees, and implications for outcrossing. *Oecologia* 53:187–196.
- Morse, D.H. 1983. Foraging patterns and time budgets of the crab spiders *Xysticus emertoni* Keyserling and *Misumena vatia* (Clerck) (Araneae: Thomisidae) on flowers. *Journal of Arachnology* 11:87–94.
- Morse, D.H. 1986. Predatory risk to insects foraging at flowers. *Oikos* 46:223–228.
- Morse, D.H. & R.S. Fritz. 1982. Experimental and observational studies of patch-choice at different scales by the crab spider *Misumena vatia*. *Ecology* 63:172–182.
- Sabino, J. & P. Gnaspini. 1999. Harvestman (Opiliones, Gonyleptidae) takes prey from a spider (Araneae, Ctenidae). *Journal of Arachnology* 27:675–678.
- Todd, V. 1949. The habits and ecology of the British harvestmen (Arachnida, Opiliones), with special reference to those of the Oxford district. *Journal of Animal Ecology* 18:209–229.
- Vollrath, F. 1987. Kleptobiosis in spiders. Pp. 274–286. *In* *Ecophysiology of Spiders*. (W. Nentwig, ed.), Springer-Verlag, Berlin.
- Whitehouse, M.E.A. 1997. The benefits of stealing from a predator: Foraging rates, predation risk, and intraspecific aggression in the kleptoparasitic spider *Argyrodes antipodiana*. *Behavioral Ecology* 8:663–667.

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